U.S. Department of the Interior

## Pamphlet accompanies map

**DISCUSSION** Between 2005 and 2007, the seafloor in the Offshore of Carpinteria map area in southern California was mapped by California State

The ground-truth surveys occurred on cruises in 2005, 2006, and 2008. The camera sleds were towed 1 to 2 m over the seafloor, at

speeds of between 1 and 2 nautical miles/hour. During the 2005 and 2006 ground-truth cruises, a smaller USGS camera sled was used

that housed two video cameras: one was forward looking, and the other was downward looking. The video was relayed in real time to the research vessel, where USGS and National Oceanic and Atmospheric Administration (NOAA) scientists recorded both the geologic and

biologic character of the seafloor once every minute, using programmable keypads. During the 2008 ground-truth cruise, a larger camera

sled was used that housed two video cameras (one forward looking, the other downward looking), a high-definition video camera, and an

8-megapixel digital still camera, which captured a digital still photograph once every 30 seconds. The locations and directions of the camera-sled tracklines were chosen in order to visually inspect areas thought to represent the full range of bottom hardness and rugosity

In the context of marine-fisheries management, benthic-habitat complexity can be divided into abiotic (geologic) and biotic (biologic) components. Benthic-habitat complexity refers to the visual classification of local abiotic and biotic vertical relief and structure that may provide potential refuge for both juvenile and adult forms of various species. Only abiotic attributes (primary- and secondarysubstrate composition) were used in the production of the seafloor-character map on sheet 5. Classifications of primary and secondary substrate are based on the Wentworth scale of sediment grain-size categories, except that granule and pebble sizes have been grouped together into a class called "gravel," and the clay and silt sizes have been grouped into a class called "mud." Primary and secondary

This sheet contains a smaller, simplified (depth-zone symbology has been removed) version of the seafloor-character map (sheet 5), on which the camera-sled tracklines used to ground-truth the sonar data are indicated by aligned colored dots, each dot representing the location of a recorded observation. Primary- and secondary-substrate compositions are shown by differently colored dots. The map also shows the locations of the detailed views of seafloor character along some of the tracklines (Boxes A through E) that are highlighted on this sheet (figs. 1A through 5A, respectively). Also shown are locations of samples (triangles) from usSEABED (Reid and others, 2006) and by Barnard and others (2009) that were used to supplement the ground-truth surveys. The seafloor-character map shows that this area is predominantly covered with sediment, but it also includes numerous oil platforms and areas of rocky outcrops. In addition, an area of

Each detailed view (figs. 1A through 5A) shows the locations of camera-sled tracklines (aligned colored dots), as well as of the photographs (colored stars) taken along the tracklines. These photographs, which are representative of the seafloor, are displayed with a

description of the observed seafloor characteristics recorded by USGS and NOAA scientists (figs. 1B through 1E, 2B through 2C, 3B

Ground-truth surveys in the Offshore of Carpinteria map area include approximately 31.72 trackline kilometers of video and 31 still

GLOSSARY

Rugosity—A GIS-derived characterization of seafloor roughness, calculated as the ratio of the three-dimensional surface area of

REFERENCES CITED Barnard, P.L., Revell, D.L., Hoover, D., Warrick, J., Brocatus, J., Draut, A.E., Dartnell, P., Elias, E., Mustain, N., Hart, P.E., and Ryan, H.F., 2009, Coastal processes study of Santa Barbara and Ventura Counties, California: U.S. Geological Survey Open-File Report

Cochrane, G.R., Golden, N.E., Dartnell, P., Schroeder, D.M., and Finlayson, D.P., 2007, Seafloor mapping and benthic habitat GIS for southern California, volume III: U.S. Geological Survey Open-File Report 2007–1271, available at http://pubs.usgs.gov/of/2007/

Reid, J.A., Reid, J.M., Jenkins, C.J., Zimmerman, M., Williams, S.J., and Field, M.E., 2006, usSEABED—Pacific Coast (California,

Tissot, B.N., Yoklavich, M.M., Love, M.S., York, K., and Amend, M., 2006, Benthic invertebrates that form habitat on deep banks off

**EXPLANATION** 

Rock and boulder, rugose—High backscatter, high rugosity; typically boulders and rugose bedrock

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**Fine- to medium-grained smooth sediment**—Low backscatter, low rugosity; typically mud to medium-grained sand;

Mixed smooth sediment and rock—Moderate to very high backscatter, low rugosity; typically coarse-grained sand,

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Mixed smooth sediment and rock—Moderate to very high backscatter, low rugosity; typically coarse-grained sand,

Interpreted substrate class depicted in digital still photograph—Indicated by colored frame around photograph (not shown

Fine- to medium-grained smooth sediment—Low backscatter, low rugosity; typically mud to medium-grained sand;

Oregon, Washington) offshore surficial-sediment data release: U.S. Geological Survey Data Series 182, available at

southern California, with special reference to deep sea coral: Fishery Bulletin, v. 104, p. 167–181.

Location of real-time video observation and interpreted substrate class of seafloor

Location of digital still photograph and interpreted substrate class of seafloor

Anthropogenic material—Related to development by humans

Backscatter intensity—The amplitude of the reflected sonar signal (see sheet 3) used to infer the hardness of the bottom, determined

through 3I, 4B through 4C, 5B through 5I). Only primary and secondary substrate are reported, although individual photographs may

photographs, in addition to 222 seafloor observations of abiotic and biotic attributes. A visual estimate of slope also was recorded.

after sonar-data processing has removed (as much as possible) the effects of water depth, angle of reflection, and bottom roughness. Biocomplexity—The assessment of the presence or absence of biological structures that have the potential of providing shelter for fauna, determined by estimating the scale, the amount, and the morphology of biological relief (as described by Tissot and others, 2006). Biocover—The visual estimate of the proportion of biologic cover by encrusting organisms: high, greater than 50 percent; moderate,

substrate constitute greater than 50 and 20 percent of the seafloor during an observation, respectively.

subaqueous delta deposits is present at the mouth of Rincon Creek, offshore of Rincon Point.

show more substrate types. Organisms, when present, are labeled on the photographs.

seafloor to the two-dimensional planar-base area, for each cell in the bathymetry grid.

between 50 percent and 10 percent; low, less than 10 percent.

http://pubs.usgs.gov/ds/2006/182/.

Substrate class

2009–1029, 926 p., available at http://pubs.usgs.gov/of/2009/1029/.

often rippled and (or) burrowed

often rippled and (or) burrowed

gravel, cobbles, and bedrock

often rippled and (or) burrowed

gravel, cobbles, and bedrock

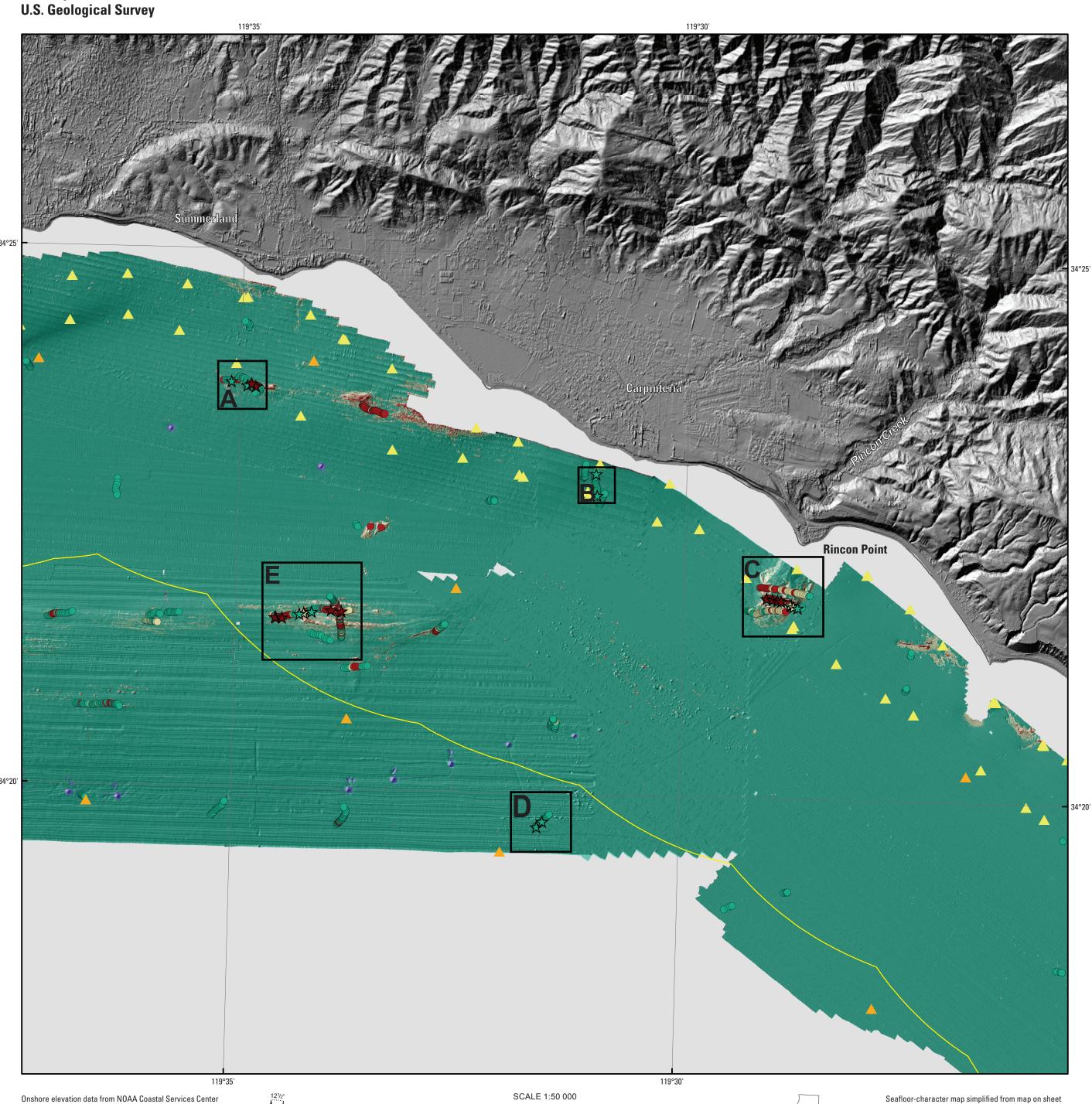
on map; shown in figures only)

often rippled and (or) burrowed

University, Monterey Bay (CSUMB), and the U.S. Geological Survey (USGS), using both multibeam echosounders and bathymetric sidescan-sonar units (see sheets 1, 2, 3). These mapping missions combined to collect bathymetry and acoustic-backscatter data from about the 10-m isobath to out beyond the 3-nautical-mile limit of California's State Waters. In order to characterize the bathymetry and acoustic-backscatter data into geologically and biologically useful information, the USGS ground-truth-surveyed the data by towing

camera sleds (fig. 6) over specific locations throughout the map area.

in the map area.



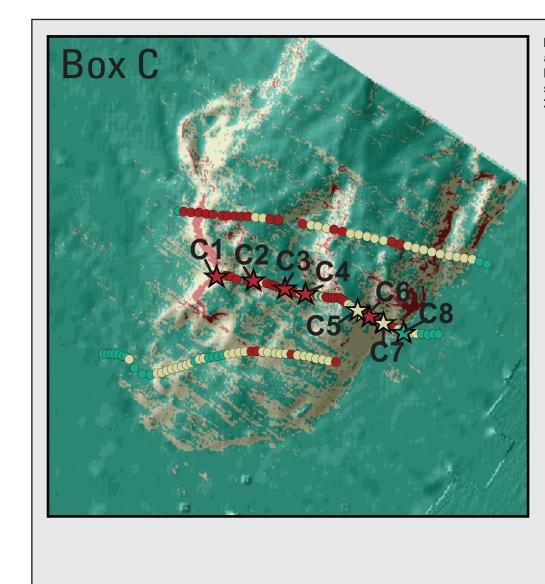


Figure 3G. Digital still photograph no. C6 (see fig. 3A for location). Cobbles

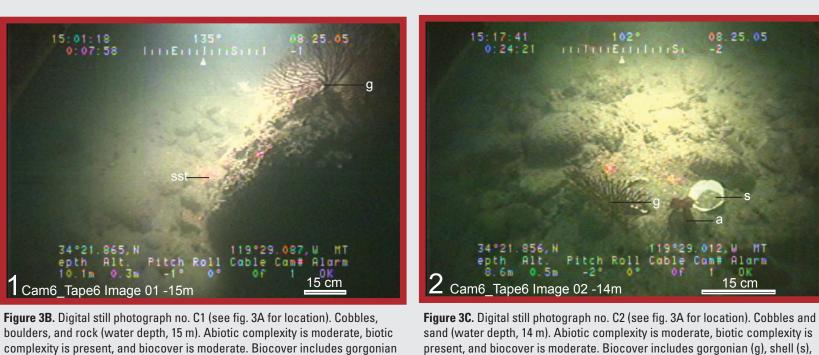
present, and biocover is moderate. Biocover includes gorgonian (g). Distance

(water depth, 15 m). Abiotic complexity is moderate, biotic complexity is

between lasers (red dots) is 15 cm.

Figure 3A. Detailed view of seafloor character mapped southeast of Carpinteria, approximately 1 km offshore of Rincon Point (see Box C, on map, for location), showing locations of periodic real-time video observations (dots) and digital still photographs (stars; see figs. 3B through 3I) from camera line CAM6, cruise S-1-05-SC (Cochrane and others,

(g) and sea star (sst). Distance between lasers (red dots) is 15 cm.



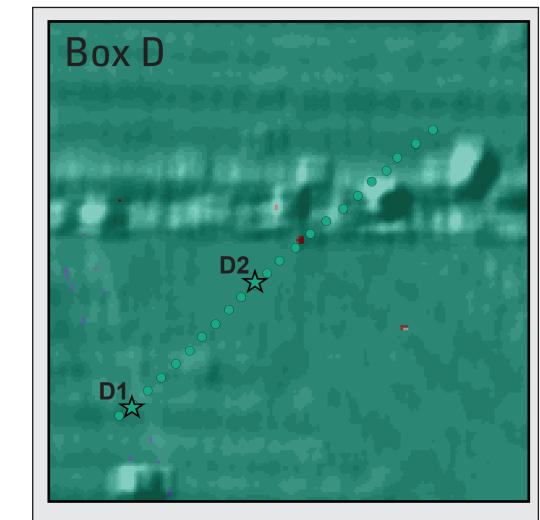
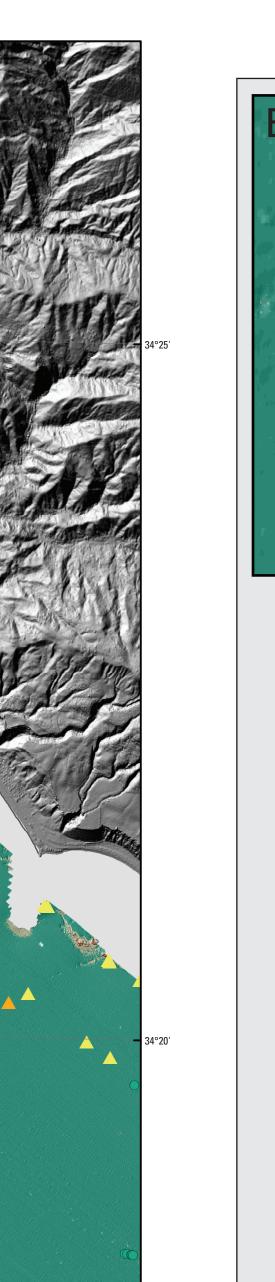
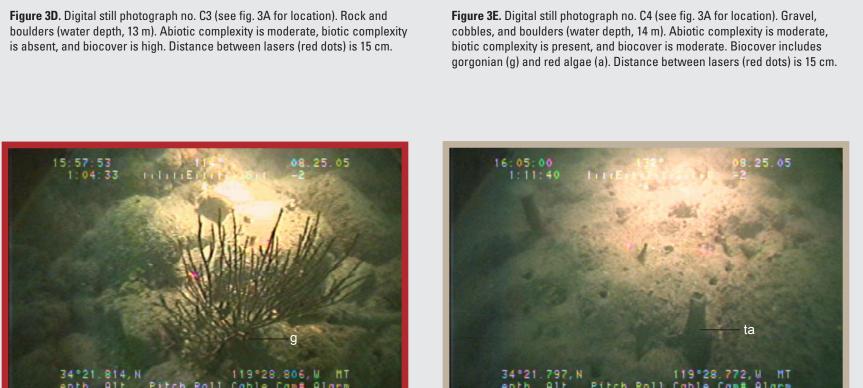
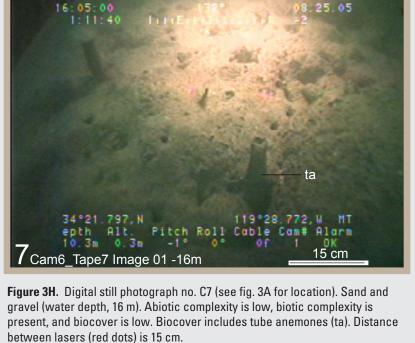


Figure 4A. Detailed view of seafloor character mapped south of Carpinteria, approximately 6 km offshore (see Box D, on map, for location), showing locations of periodic real-time video observations (dots) and digital still photographs (stars; see figs. 4B, 4C) from camera line CAM12, cruise S-1-05-SC (Cochrane and others, 2007).

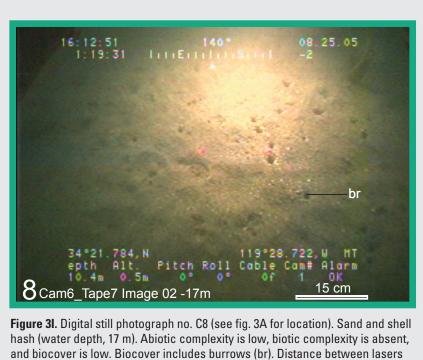








others, 2007).



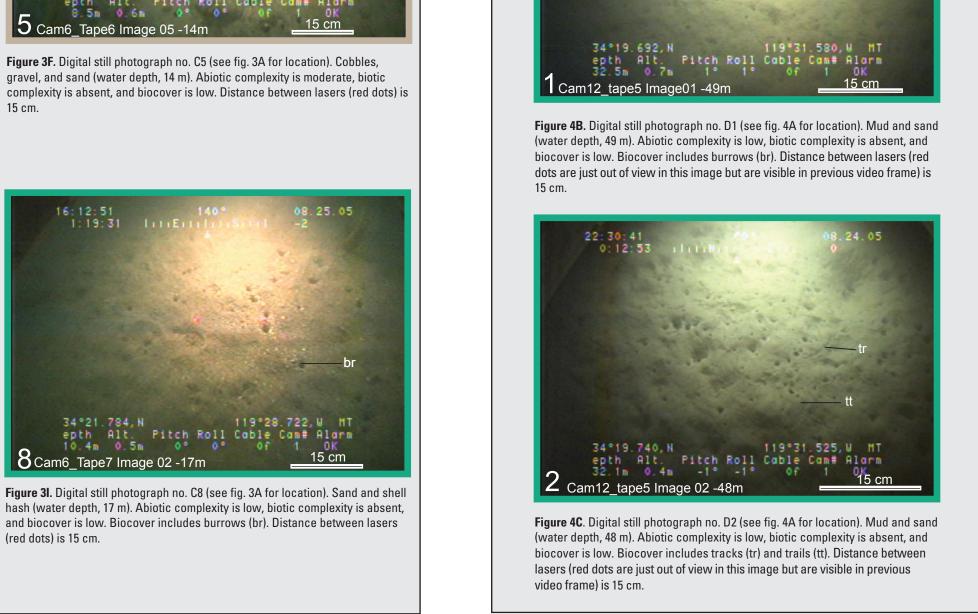
(red dots) is 15 cm.

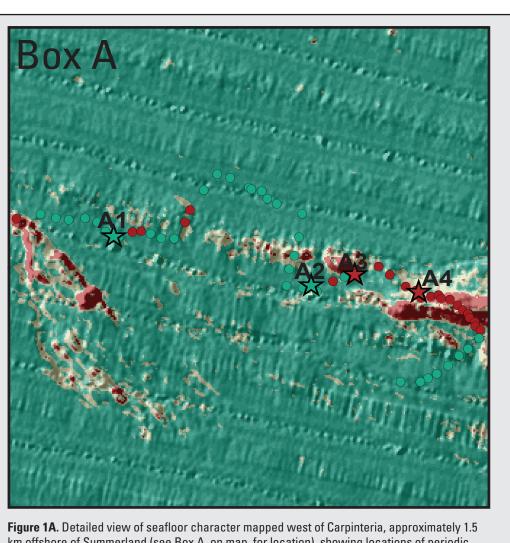
Figure 5A. Detailed view of seafloor character mapped southwest of Carpinteria,

figs. 5B through 5I) from camera line CAM32, cruise S-1-05-SC (Cochrane and

approximately 5 km offshore (see Box E, on map, for location), showing locations of periodic real-time video observations (dots) and digital still photographs (stars; see

and red algae (a). Distance between lasers (red dots) is 15 cm.





(data collected by EarthData International in 2002-2003) and

from U.S. Army Corps of Engineers (data collected by Fugro

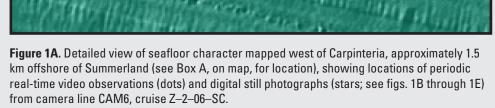
map on sheet 2, this report. California's State Waters limit

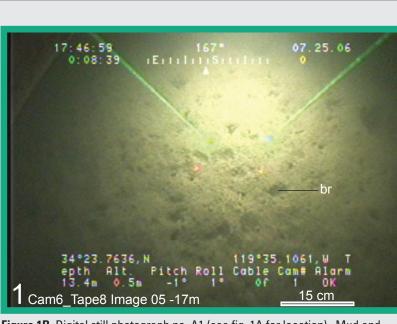
Pelagos in 2009). Offshore shaded-relief bathymetry from

Universal Transverse Mercator projection, Zone 11N

NOT INTENDED FOR NAVIGATIONAL USE

from NOAA Office of Coast Survey





1 KILOMETER

1 0.5 0 H H H H H

ONE MILE = 0.869 NAUTICAL MILES

Figure 1B. Digital still photograph no. A1 (see fig. 1A for location). Mud and sand (water depth, 17 m). Abiotic complexity is low, biotic complexity is absent, and biocover is low. Biocover includes burrows (br). Distance between lasers (red dots) is 15 cm.



**Figure 1D.** Digital still photograph no. A3 (see fig. 1A for location). Rock outcrop (water depth, 19 m). Abiotic complexity is moderate, biotic complexity is present, and biocover is moderate. Biocover includes gorgonian (g) and sea cucumber (sc). Distance between lasers (green dots) is 15 cm.

gure 2A. Detailed view of seafloor character mapped approximately 200 m offshore of Carpinteria (see Box B, on map, for location), showing locations of periodic real-time video

observations (dots) and digital still photographs (stars; see figs. 2B, 2C) from camera line

CAM15, cruise S-1-05-SC (Cochrane and others, 2007). Video was used to determine at

what depth does transition from soft, muddy, bioturbated sediment to sand ripples occur;

Figure 2B. Digital still photograph no. B1 (see fig. 2A for location). Fine sand with

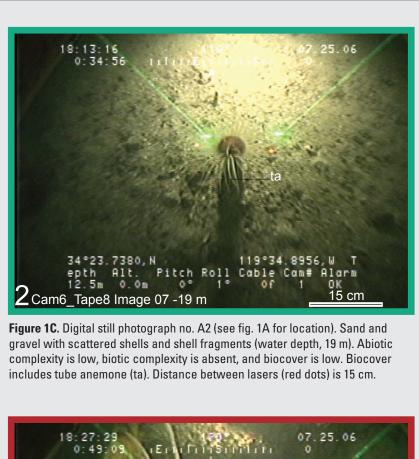
is low, biotic complexity is absent, and biocover is low. Biocover includes burrows

(br). Distance between lasers (red dots) is 15 cm.

degraded wave ripples in confused pattern (water depth, 19 m). Abiotic complexity

video observations of these lines indicated that degradation of ripples by bioturbation

occurred at depth of 20 m.



5. this report. Video observations recorded and digital

still photographs taken in 2007-2008. Sample localities

from usSEABED (Reid and others, 2006) and from

GIS database and digital cartography by Nadine E.

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Barnard and others (2009)

Golden and Eleyne L. Phillips

Edited by Taryn A. Lindquist

MAP LOCATION

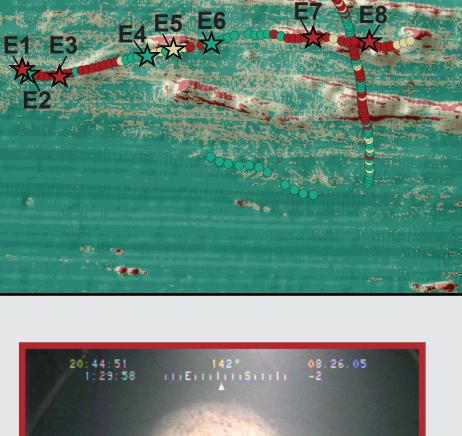
Figure 1E. Digital still photograph no. A4 (see fig. 1A for location). Rock and boulders (water depth, 18 m). Abiotic complexity is high, biotic complexity is present, and biocover is moderate. Biocover includes bat star (bas). Distance

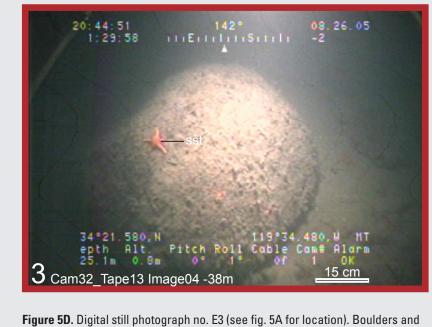
between lasers (green dots) is 15 cm.

Figure 2C. Digital still photograph no. B2 (see fig. 2A for location). Fine sand with

sharp crested wave ripples (water depth, 13 m). Abiotic complexity is low, biotic

complexity is absent, and biocover is low. Distance between lasers (red dots) is 15





sand (water depth, 38 m). Abiotic complexity is moderate, biotic complexity is absent, and biocover is moderate. Biocover includes sea star (sst). Distance between lasers (red dots) is 15 cm.

Figure 5G. Digital still photograph no. E6 (see fig. 5A for location). Sand and mud

(water depth, 38 m). Abiotic complexity is low, biotic complexity is absent, and

biocover is low. Biocover includes burrows (br) and bat star (bas). Distance

between lasers (red dots) is 15 cm.

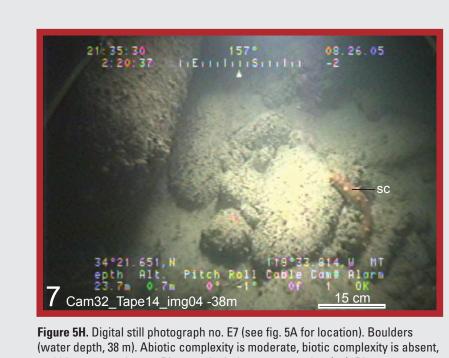


Figure 5E. Digital still photograph no. E4 (see fig. 5A for location). Sand and mud

with scattered shells (water depth, 38 m). Abiotic complexity is low, biotic

complexity is absent, and biocover is low. Biocover includes burrows (br).

Distance between lasers (red dots) is 15 cm.

Figure 5B. Digital still photograph no. E1 (see fig. 5A for location). Rock and sand

(water depth, 39 m). Abiotic complexity is moderate, biotic complexity is absent,

and biocover is moderate. Biocover includes sea cucumber (sc). Distance

between lasers (red dots) is 15 cm.

and biocover moderate. Biocover includes sea cucumber (sc). Distance between lasers (red dots) is 15 cm.



Figure 5C. Digital still photograph no. E2 (see fig. 5A for location). Sand and mud (water depth, 39 m). Abiotic complexity is low, biotic complexity is absent, and biocover is low. Biocover includes burrows (br). Distance between lasers (red dots) is 15 cm.

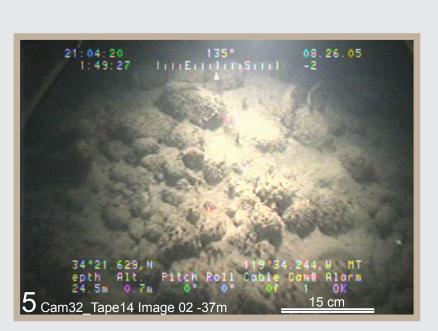


Figure 5F. Digital still photograph no. E5 (see fig. 5A for location). Cobbles, gravel, and sand (water depth, 37 m). Abiotic complexity is low, biotic complexity is present, and biocover is moderate. Distance between lasers (red dots) is



cobbles (water depth, 36 m). Abiotic complexity is moderate, biotic complexity is present, and biocover moderate. Biocover includes gorgonian (g) and sea cucumber (sc). Distance between lasers (red dots) is 15 cm.

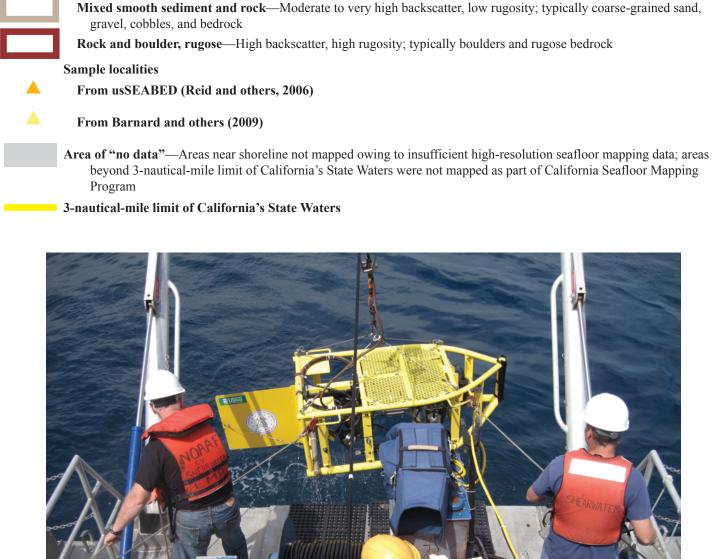


Figure 6. USGS-designed camera sled being launched off research vessel for ground-truth studies. Components onboard sled include four digital video camcorders, one 8-megapixel digital SLR camera, lasers for scale, and various strobe and video lights, as well as telemetry instrumentation that records depth, altitude, and compass heading.

proportions may not be true on plots of this map.

Digital files available at http://pubs.usgs.gov/sim/3261/







and between X and Y directions on the same plotter, and paper may change size due to atmospheric conditions; therefore, scale and

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and S.A. Cochran, eds.), California State Waters Map Series—Offshore of Carpinteria, California: U.S. Geological Survey Scientific Investigations Map 3261, pamphlet 42 p., 10 sheets, scale 1:24,000, http://pubs.usgs.gov/sim/3261/.

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